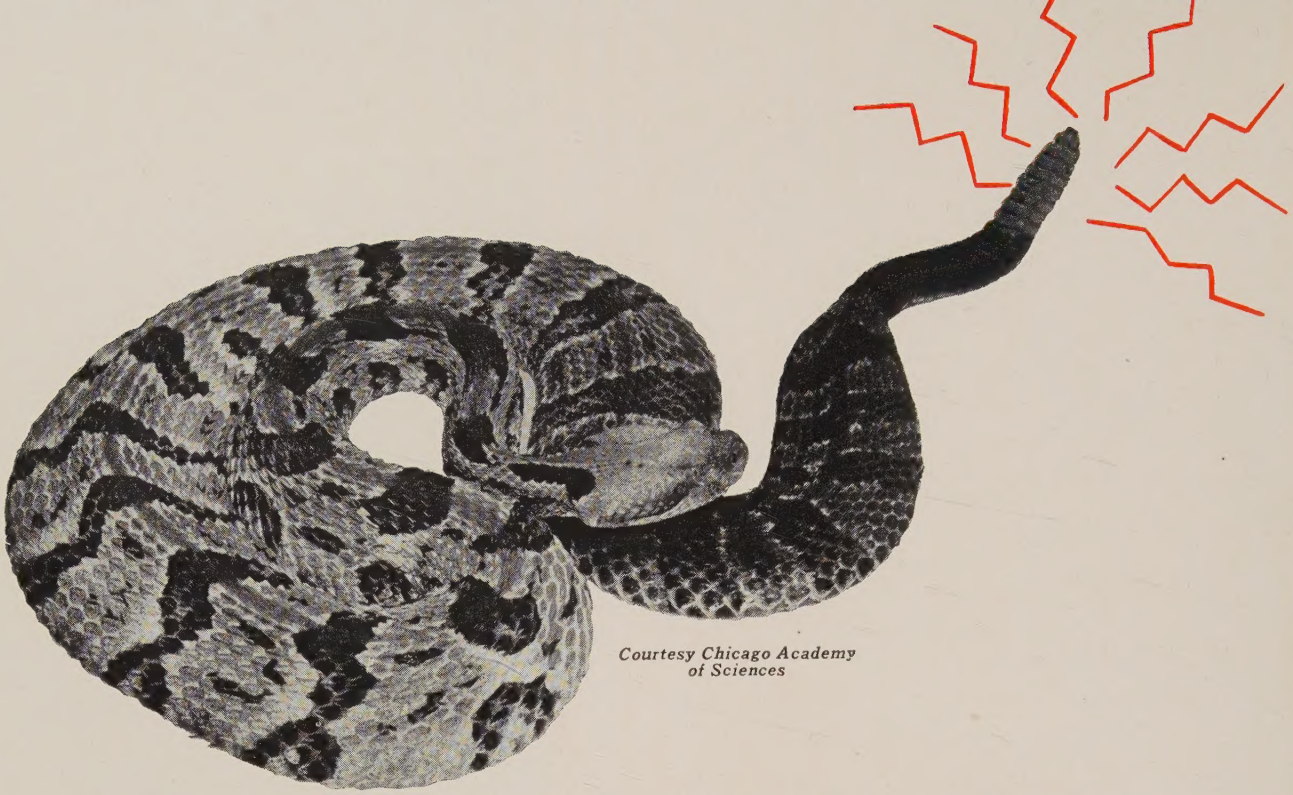
Grain

THE MAGAZINE OF PLANT MANAGEMENT AND OPERATION

DECEMBER, 1946



Courtesy Chicago Academy of Sciences

A RATTLESNAKE WARNS *BEFORE* IT STRIKES

A DUST EXPLOSION DOESN'T!

. . . it l-a-s-h-e-s out, *UNHERALDED, UNEXPECTED!* And then, one of two things happen: (1) It expands, extends destruction with violent secondary explosions;

(2) Or the blast, which probably originates in the elevator leg, is dispersed and little or no damage results.

Robertson Safety Ventilators, equipped with safety top and operating with gravity action, continuously vent *DANGEROUS* fine Dust from your elevator legs.

SHOULD a primary explosion develop, it is i-m-m-e-d-i-a-t-e-l-y *USHERED out* through the Robertson vent . . . s-t-o-p-p-e-d from s-p-r-e-a-d-i-n-g!

PLAY SAFE with Robertson Safety Ventilators! Write *today* for descriptive literature.

H. H. ROBERTSON CO.

Farmers Bank Bldg. Pittsburgh, Pa.

In addition to Quantity

QUALITY OF 1946 CROPS

Is Outstanding, Too

Volume Up 26% Over Average, 7% Above '45

More important than the history-making size of 1946 grain crops is the excellent quality. However, new crop peaks are always a matter of pleasurable interest.

Farmers produced their biggest crop in history this past season, topping even the previous record output in 1942. All-time peak yields of corn and wheat, coupled with record or near-record harvests of many other crops produced a volume 26% above the 1923-32 average, 2% above the previous high in 1942, and 7% above last year's production.

The corn crop totaled 3,287,927,000 bu. and compared with 2,880,933,000 bu. last year and a previous record of 3,228,000,000 bu. in 1944. Average corn production from 1935 to 1944 was 2,608,499,000 bu.

Wheat production totaled 1,155,715,000 bu., comparing with 1,108,224,000 bu. last year, the previous high. Average wheat yield from 1935 to 1944 was only 843,692,000 bu. Other major crops, compared with last year's revised production, reported in bushels by the USDA, were:

	1946	1945
Oats	1,509,867,000	1,535,676,000
Barley ...	263,350,000	266,833,000
Soybeans .	196,725,000	192,076,000
Flax	22,962,000	34,557,000
Rye	18,685,000	23,952,000
Rice	71,520,000	68,150,000

"Not only the quantity but also the quality of the crops is outstanding," the department emphasizes.

RICE PRODUCTION RISING

While 11% larger than last season's short production, the estimated 7.1 billion bushel world's 1946-47 rice crop is still 4% under the prewar average harvest. North America's crop set a record, however early forecasts indicate that South American harvests may be smaller than last year's bumper crops.

SOYBEAN CROP TOPS

The 1946 soybean crop reached an all-time record high of 197,000,000 bu. despite the smallest acreage harvested since 1941, announces the USDA.

SURPLUSSES ANTICIPATED

All restrictions on the production of flour for domestic distribution and for export to license-free countries are being removed, and regulations on the use of corn and rye by brewers and distillers liberalized, the USDA announces, in anticipating substantial surplusses in the future as a direct result of the record grain crops of 1946.

"Yes, we finally found a nice little one room place."

WINTER WHEAT YIELD 946,000 BU

With normal weather conditions prevailing during the balance of the current crop year, production of winter wheat next June may reach the stupendous total of 946,527,000 bu, forecasts the USDA. The indicated crop compares with 873,893,000 bu in 1946, 817,835,000 in 1945, and the 10-yr (1935-44) average of 618,019,000 bu.

Acreage seeded rose from 52,206,000 in 1946 to 56,426,000, which figure is considerably up from the 10-yr average of 46,890,000 acres. Yields, too, are rising, with an indicated 16.8 bu per acre for the crop now in the ground as compared with 16.7 last year and the 10-yr average of 13.4. The condition of the crop was 11 points higher than on the same date of Dec. 1 last year, for a big 93%. The average is 76% over the 1935-44 period.

NEED 10% MORE CARS

With all commodities combined requiring an anticipated need for 8.8% more box cars during the first quarter of 1947, loadings of all grains will rise 10.2%, or from 367,909 cars actually loaded during the first quarter of 1946 to 405,373 this year, and loadings forecast for flour, meal and other mill products will jump 2.7%, or from 268,815 last year to 275,966 this year.

BRITAIN TO BUY U. S. FLOUR

In addition to granting railroad priorities to move many trainloads of Canadian wheat, the U. S. has promised to ship 72,000,000 lbs. more flour to Britain at once.

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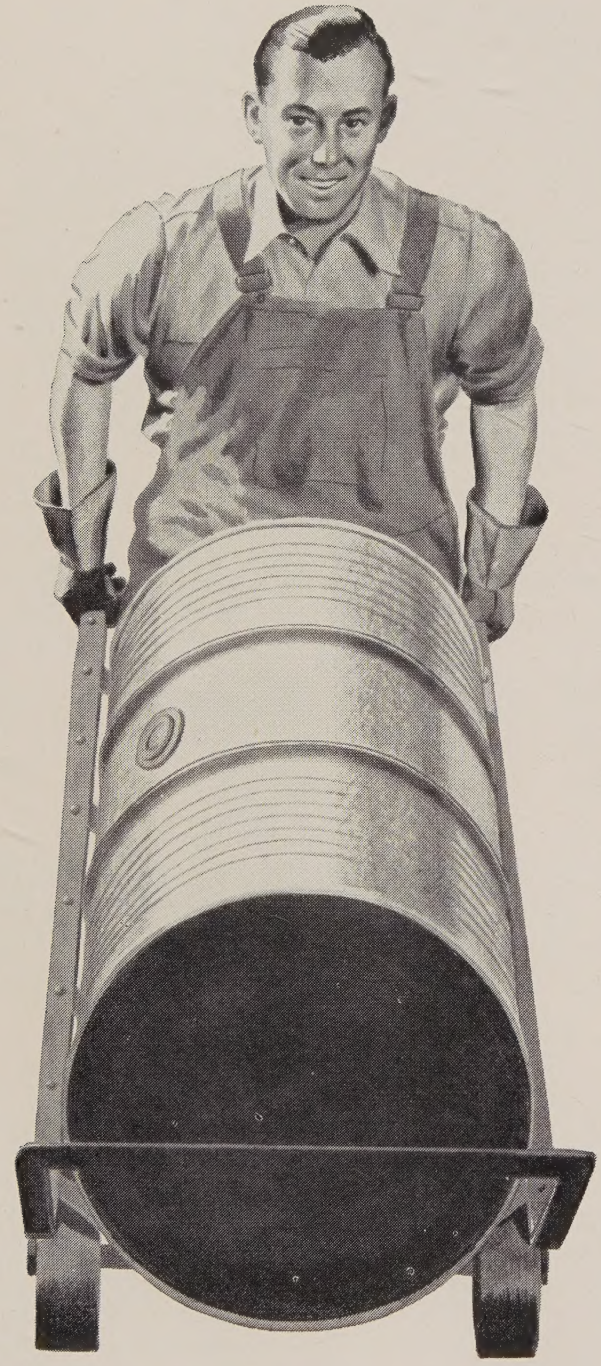
TODAY, DRUMS ARE THE LIFELINE FOR CHEMICALS



Return DRUMS Promptly!

You are having difficulty obtaining as much vital material as you need. Prompt return of drums is essential to the flow of available chemicals.

Steel is short—we can't purchase all the new drums that we need. We must re-use all containers in serviceable condition. We are relying on you.

This appeal does not apply to Dow's West Coast customers.

Empty Drums Are Vital
Help Us KEEP 'EM FULL!

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN
New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

PROPOSE NEW OATS GRADE

Designed to provide a better description on certificates for oats of all classes and of all grades which have a test weight of 32 pounds or more per bushel—but less than 35 pounds—is a proposed grain standards amendment. While not applying to No. 1 grade, if promulgated, the amendment will be in the form of a special grade of "Medium Heavy Oats" substantially as follows:

"DEFINITION. Medium Heavy Oats shall be oats of any grade other than Grade No. 1 which have a test weight per bushel of 32 pounds or more but less than 35 pounds.

"GRADES. Medium Heavy Oats shall be graded and designated according to the grade requirements of the standards applicable to such oats if they were not medium heavy, and, except in the case of Grade No. 1, there shall be added to, and made a part of, the grade designation, preceding the name of the class, the words 'Medium Heavy'."

RUST-RESISTING OAT DEVELOPED

Canada's agricultural scientists have come through with another victory over nature. It's a new strain of oats that is able to resist stem and crown rust—which blights have forced farmers in some sections to abandon oats production and turn to other cereals. The strain will also resist loose and covered smut which has made its appearance in some oats-growing areas.

NEW FLAX FIBER HIGH

Fiber flax improvement work has brought out a new variety that is disease resistant and an outstanding yielder. Known as Cascade, the new strain is the result of a cross by Dr. B. B. Robinson of the USDA. Surpassing all others both in tonnage and percentage of fiber, tests in the Groveland district of Oregon—practically the only state producing fiber flax—brought a yield of slightly more than four tons per acre for a national record. Raising high-fiber flax promises to become increasingly important.

ONLY UNFIT GRAIN FOR WHISKEY

Sale of wheat or any wheat product for distilling purposes—unless unfit for human consumption—was prohibited by the Canadian Wheat Board on Dec. 19. Regardless of its unfitness, approval must be obtained for all such sales.

NO CORN MARKETING QUOTAS

No corn marketing quotas and no corn acreage allotments for the 1947-48 corn production and marketing season will be established by the USDA, in accordance with provisions of the AAAct. Corn, including food and feed products thereof, but except protein meal, sweeteners, and oils, was removed from the "short-supply" list. Furthermore, restrictions against the use of corn (but not wheat and rye) by distillers are now discontinued and/or eased.

FARM SIZES UP

Farms over 1,000 acres in size in the U. S. now exceed 100,000 in number, says the USDA. The average size of all farms combined, which totaled 134 acres in 1880, has now expanded to 200 acres today.

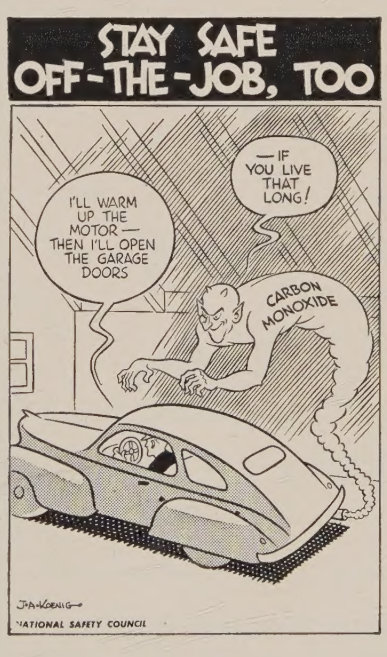
SOYA PAINT OUTLASTS STEEL

An enamel made from a soybean oil modification of glyceryl phthalate type resins has been formulated by Ford Motor Co. It is expected to outlast the steel car body.

Grains Cannot Be Better Than Soil in Which Grown

Not only was the high percentage of the 4-Fs rejected for military service in World War II, the result of depletion of food elements in our soils, according to Dr. H. C. Byrd, president of the University of Maryland, in addressing the Soil Conservation Society of America, but unless a $6,000,000,000 soil conservation program is launched quickly then some $20,000,000,000 worth of land will become destroyed.

Dr. Hugh H. Bennett, chief of the U. S. Soil Conservation Service, testified the country faces the loss of 50,000,000 acres of fertile farm land and serious damage to an additional 100,000,000 acres within the next century unless a 20-year nation-wide program of basic conservation work is undertaken. To the loss arising from the destruction of land should be added the cost of permanent losses in production, he pointed out.



WHEAT HEAVILY INFESTED WITH INSECTS

A leading mill chemist tells us that the 1946 crop is the most heavily infested with insects that he has ever seen. In view of the fact that there was little wheat carryover from the previous crop last summer, this fact seems to demolish the old theory that insects are largely harbored in old wheat. This chemist thinks that the present condition is due to the high average moisture content of the 1946 crop.—Millers' National Federation.

STATE OFFICIALS AFTER BUGS

The state of Minnesota is intensifying its drive against infestation, Dr. Henry J. Hoffman, director of the food laboratory, department of agriculture, St. Paul, told the Minnesota Allied Trades of the Baking Industry recently.

More Attention to Wheat Cleaning Equipment

Regulatory officials are placing emphasis on that clause of the Food, Drug and Cosmetic Act which says that food shall be deemed to be adulterated if prepared under insanitary conditions. Inspectors will not be content to inspect the finished food product, but may be expected to devote the greater part of their inspection to general cleanliness and insect and rodent population of the place where food is processed. To the industry this means that not only open space in the plant, but the inside of elevator boots, conveyors, sifters and other milling machines must be kept practically insect free.

Unlike many food processors whose finished product is ready for consumption, our operation is an inter-

mediate one and so becomes the baker's raw material. While extraneous matter count in flour as produced at the mill may be secondary to the federal inspector, it is primary to the baker. The baker thus becomes an additional mill inspector.

Bakers are giving greater attention to this factor. There are already a few instances where certain milling companies have been removed from bakers' approved lists because of high insect fragment and rodent hair count in flour.

The evidence seems quite conclusive that rodent hair fragments find their way into the mill along with roll wheat. The same is partially true of insect fragments. It seems wise, therefore, that the industry give serious attention to their wheat cleaning equipment.

A few investigators have found rodent hairs enmeshed in the wheat hairs on the end of the wheat kernel even after the wheat has been cleaned in preparation for milling. Other investigators have substantial proof that insects in various stages may be sealed inside of occasional wheat kernels in the cleaned mill mix.

Until extraneous matter count in flour came into use, the miller had no satisfactory way to measure the adequacy of his wheat cleaning system. It has been suggested that with slight modifications, the method now used to determine fragments in flour might be adapted to either whole grain or very coarsely ground wheat.—Millers' National Federation.

MILLERS BLAME GRAINMEN FOR BUGS

Insect infestation in wheat should be combated before it enters the mill, O. W. Stone of The Drexel Co., St. Louis, told AOM's District 5 recently. Infested wheat, he emphasized, accounts for over 95% of the insect infestation in the mill. An electrical apparatus now under construction for destroying insect life in wheat was then described, Mr. Stone adding that this large 6,000 volt, ⅛ ampere machine could treat wheat for 1/50c per bu at capacities up to 1,000 bu per hour.

TO PUSH FLOUR SALES JOINTLY

Flour consumption is to be promoted on a long range program through a national publicity and advertising campaign directed under the auspices of the Millers' National Federation. In taking strong affirmative steps to increase consumer interest in and use of products made from flour, the milling industry feels that a probable severe slump in flour consumption can thus be avoided.

ONLY STANDARD SIZE NOW

Rolled barley in sacks of a net weight content of 75 lbs. will hereafter be the only allowable standard in California—the wartime modification to conserve burlap having been rescinded.

CORN PROTEIN NECKTIE

Considerable work in developing textile fibres from Zein, the chief protein of the corn kernel, has been done by the Northern Regional Research Laboratory in Peoria, Ill. A red hand-woven necktie on display at the lab would indicate that there may be considerable market value in industry should early developments continue to show promise when developed on a larger scale in commercial production.

IT'S A DATE!

May 15-16-17—Hotel Continental, Kansas City, Mo.—18th Annual Convention of the Society of Grain Elevator Superintendents and Processors.

WHY GRAIN SPOILS IN STORAGE

By Dr. MAX MILNER of Minnesota Agri. Exp. Station

RESEARCH workers have shown that certain molds commonly found in soil, whose spores may be carried about freely in the air, are almost invariably present in normal grain, even though this grain be grown and harvested under ideal conditions.

How and at what stage of growth these molds become established in the seed coats is not known. Their presence there is perfectly harmless as long as the moisture content of the seeds remain below the critical value.

However, if the moisture content exceeds the minimum required for their germination, and if other conditions such as temperature and the supply of nutrients are suitable, the mold spores germinate and produce abundant growth.

Excreted Ferments Cause Chemical Deterioration

GROWING molds are vigorous producers of carbon dioxide and heat. They excrete powerful digestive ferments into the seed which break down its constituents. This causes chemical deterioration of the starches, proteins, and fats and results in a decrease in grain quality.

When moisture and heat cannot readily escape, such as in a large grain bin or a railroad car, the heating effects due to mold respiration may become pronounced, with the result that deterioration proceeds at an even more rapid pace.

The moisture point at which the contaminating molds begin their growth varies with different grains. Thus the critical moisture level for wheat is about 14.5%, flaxseed 10.5%, soybeans 14%, and corn about 14%.

Air Humidity a Factor

WHEREAS these moisture values may be different in the various species of seed, they are all in equilibrium with approximately the same relative humidity of the air surrounding the seeds, namely 74 to 75%.

The same kinds of molds are usually present on these different seeds, and it is these molds which begin to grow at the common air humidity level of 75%, or at the critical moisture value of the seed at this humidity.

Furthermore, if the grain is frozen, weathered, threshing damaged, shriveled, or immature, the mold spores will germinate and grow at a somewhat lower humidity than they would on sound, mature seed, for the reason that nutrients are much more easily available to the mold on the damaged grain.

Respiration of Grain

ALTHOUGH mold growth is the principal cause of respiration, heating and deterioration of grain at relative humidities above 75%, the respiration of the seed itself is also a factor. At humidities below that critical for mold growth, the respiration of grain is almost entirely due to the seeds. About this point, the molds are the principal contributors to respiration.

Quantitative separation of the two types of respiration has recently been accomplished. This makes possible the measurement of the sensational increases in the respiration and heating of grain as a result of mold growth.

For example, assign a value of one to the respiratory rate of a sound sample of Regent wheat at 14.3% moisture (74% relative humidity) where only seed respiration is involved. At 14.6% moisture (75% reltive humidity) where mold growth makes its appearance, the seed respiration rate is up only a little to 1.25, while that due to molds is 5.

At 16% moisture (80% relative humidity) the respiration rate of the seed is only about 2.5, while that due to molds growing on the seed has zoomed to around 75.

Germination Killed at 110° F.

MOREOVER, it is known that at moisture values where seed germination occurs (35% or more), heating due to germination ends with the death of the seedlings at about 110° F., whereas molds will produce and tolerate temperatures up to 130° F.

If the moisture content of the grain is very high and approaches equilibrium with a relative humidity of 100% in the atmosphere, bacteria may begin to grow. Certain species of these microorganisms can produce temperatures as high as 160° F.

Grain damage, which may be brought about in a short time by mold growth, may appear at the same moisture values but at a much slower rate when mold growth is absent.

Sick Wheat

AMONG the types of damage not due to mold growth but to the influence of high moisture on the seed metabolic processes is that known as "sick" wheat. This condition, which may arise in damp wheat in bulk storage, is characterized by loss of viability and a darkening of the germ portion of the grain.

The baking quality of flour produced from such grain is very poor. This condition appears to be associated under practical conditions with very high interseed carbon dioxide concentrations which would suppress the mold growth.

Mold Spores, Bacteria "Seeds" Cause the Trouble in Wet Grains

Corn, when it is ripening or perhaps when it is shelled, picks up a natural amount of mold spores and bacteria "seeds." These fungi seem to concentrate inside each individual kernel in the tiny crevices between the germ and the food or starch portion of the kernel.

In a normal year these molds are dormant. However should the harvest season be wet then the grain naturally has a higher moisture content. It is this high moisture content that furnishes ideal conditions for the mold spores to grow and multiply.

Of course, temperature conditions also have a decided bearing on the growth of the spores. I believe it is a fact that the molds will flourish under a wider temperature range than a moisture range. Be that as it may, the addition of sulphur dioxide, which is a very good fungicide, stops their growth. The SO_2 enters into the crevices between the germ and the starch portion, combines with the moisture present to form sulfurous acid (we think).

Evidentally many of the mold spores and mature molds that affect

grain cannot grow or exist in an acid condition. Therein lies the inhibiting effect of sulphur dioxide. At least that is the conception I have of the entire matter as it was given to me by a research worker in one of the large grain laboratories.—A. O. Wingender, Ansul Chemical Co., Marinette, Wis.

Smallman Heads New Dominion Laboratory To Fight Insect Pests in Grains

A new research laboratory to fight the threat of insect pests to stored grain and grain products has been opened in the Dominion Public Building in Winnipeg by the Science Service Branch of the Dominion Department of Agriculture. Dr. B. N. Smallman, former entomologist for the Board of Grain Commissioners for Canada, and often a featured speaker on the annual program of the Society of Grain Elevator Superintendents, is in charge.

The services of this new research lab will be available to the grain trade, the milling industry, to feed manufacturers and blenders, and any other segment or related business which may require assistance.

Piled up wartime surpluses of grain, which forced provision for 175,000,000 bushels of emergency storage facilities, aggravated the danger from insect pests and brought new problems for the entomologist. With stored wheat the insect enemies were the grain mite, the rusty grain beetle (both known in the west before), and the true grain weevil—which appeared for the first time in western Canada in the crop years of 1942 and 1943.

Never before reported on the prairies, the entomologist located the true grain weevil in ten lots of stored grain in the corn growing belt of south central Manitoba. Use of gases got it under control, and the relatively small quantity of grain affected was kept out of the usual channels of the grain trade. No cases have been reported since 1943.

In cases of grain processing plants and warehouses the confused flour beetle and the spider beetle have been curbed through successful efforts which Dr. Smallman reports have proved 98% more effective than those previously employed. New types of sprays and insecticides, valuable chiefly for their residual effect, have been made available to entomologists and give encouraging promise.—Percy C. Poulton, N. M. Paterson & Co., Ltd., Ft. William.

IS RIPLEY RIGHT?

In Ripley's "Believe It Or Not" column there appeared the following:

"A bushel basket will hold: 550,000 kernels of wheat, 520,000 kernels of barley, 1,260,000 kernels of oats, and 27,000 beans."

Probably nobody will ever know or have the patience to count these kernels, but just as a friendly check-up, is Ripley's assertion nearly correct? —Wavne Harbour, Harbour & Son, Bedford, Iowa.

Answer: The Federal Board of Review disagrees with Mr. Ripley. They state there are 30 kernels of wheat per gram, 453 grams per pound, and 60 pounds per bushel of wheat. This totals 815,400 kernels. The Federal Board of Review points out, however, that there probably is a variation of up to 100,000 kernels per bushel between different types and varieties of wheat, as well as in other grains. Other figures were thought to be proportionately off.

Accidents Take Heavy Toll

SUFFOCATED IN BIN

While cleaning a clogged spout, an Iowa elevator employee is believed to have walked on top of the corn in a bin which was crusted by dampness. He fell through a hole in the top crust, resulting in a landslide of corn burying him. A hole was cut in the side of the bin to release him, but the fire department and doctors worked in vain to revive him.

SUFFOCATED IN BIN

Michael J. Herlihy, 48, was suffocated when he fell through an open chute in Armour & Co.'s grain elevator and was buried under two feet of corn. Herlihy had been filling bins and leveling off corn inside the Chicago meat packers stockyards elevator when he apparently slipped and fell. Workmen dug him out but rescue-squad firemen were unable to revive him.

SACKS FALL ON WORKMAN

A fractured right leg was suffered by a Kansas City workman when a pile of sacked feed fell on him. Alone at the time of the accident, the injured man courageously crawled to a phone and summoned aid. He had been employed 21 years.

INSURANCE RATES TO RISE IN MINNESOTA

Changes in the Minnesota laws extensively broadening workmen's compensation provisions, boosting allowances and benefits paid for industrial accidents, and reducing maximum working hours for women and minors under 16, are proposed by the state industrial commission. Considerable increases in insurance rates will result if the changes go into effect.

ENEMY NO. 1—OCCUPATIONAL DISEASE

A recent study of 3,123 reportedly accidental deaths in industry, says Uncle Sam, indicates that only 409, or 13%, were actually the results of accidents; the remainder were the result of health factors known as "occupational disease". Now, reports the striped-pants gentleman, all jobs are being carefully analyzed, scrutinized and classified by the insurance underwriters—and no detail is going to be too small or obscure to consider.

There are nine general classifications into which occupational hazards in industry are divided, namely: 1—Abnormalities in temperature; 2—Compressed air; 3—Dampness; 4—Defective illumination; 5—Dust; 6—Infection; 7—Radiant energy, X-ray; 8—Repeated motion or pressure, and 9—Poison, chemicals, etc. It was through a study of these classifications and an analysis of the greatly varying dangers therein that it was clearly indicated disease normally takes so many times more lives than do accidents, according to this report.

If women think that all men are alike, then why is it they are so particular in picking one?

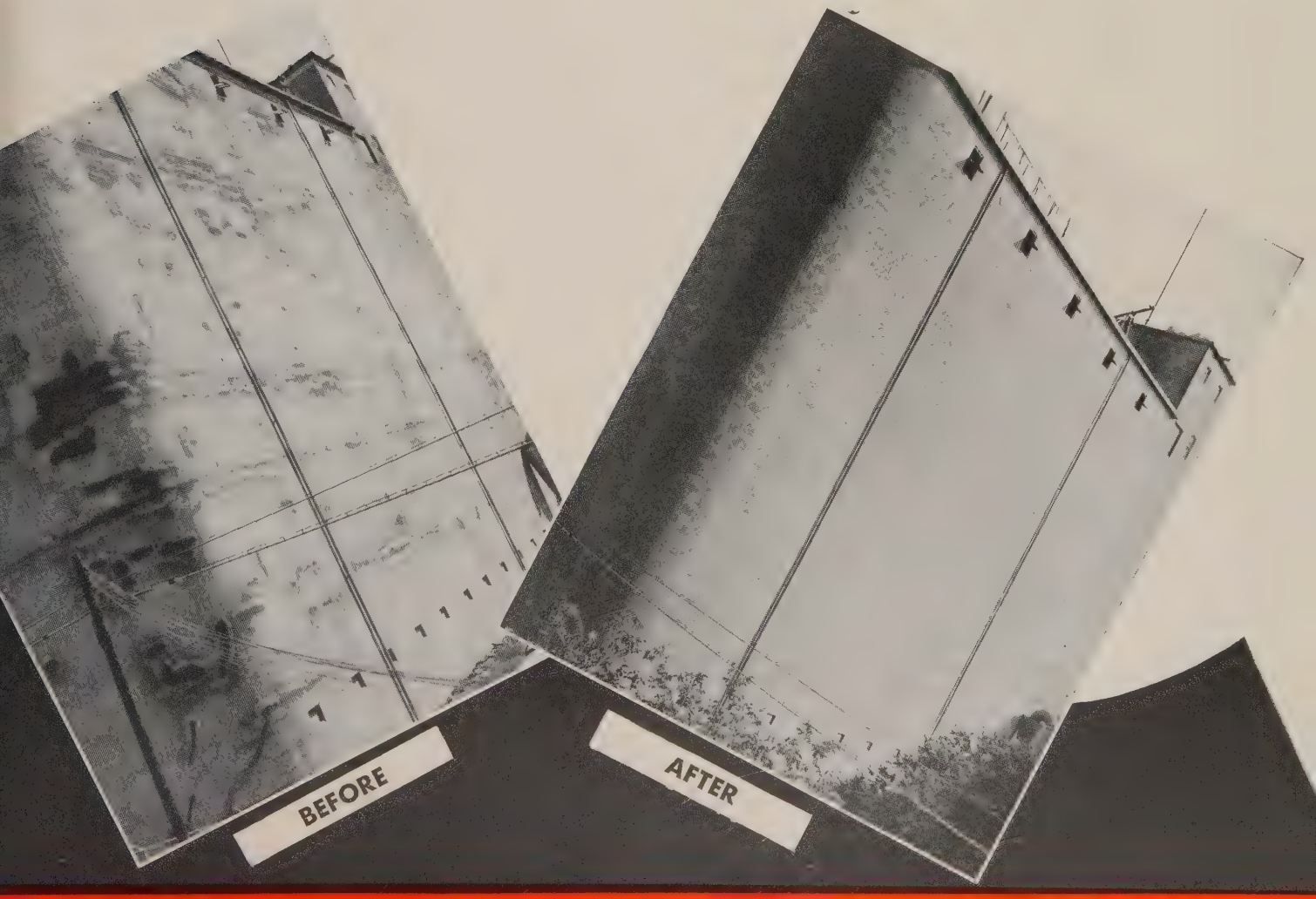
B. J. MANY CO., Inc.

SULTS ACCOMPLISHED

The Yardstick By Which To Measure The Real Worth of Repairs and Weatherproofing

The before and after pictures shown here are typical examples of *results* invariably secured by the B. J. Many Company, Inc., when repairing and weatherproofing grain tanks and elevator work houses.

A B. J. Many job lasts longer, is worth more: naturally costs more. Cheap materials and faulty workmanship represent false economy.



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Northland Machinery Supply Co., Ltd., 203 Hardisty Street, Ft. William, Ont.

The Oiler Is King-Pin In

Preventive Maintenance

By JERRY McGEORGE, Roby, Indiana, American Maize-Products Company

EROSION, Corrosion and Overstress, these are the enemies of the Maintenance Department. Acting either singly or in combination, these forces are constantly working at the grim business of destroying our buildings and production equipment. Engineers and chemists are trained to recognize these foes, and wage continual battle through the use of better design and improved materials of construction.

They have given us materials that minimize frictional wear in the form of bearing alloys and hard surfacings and also designs for the same purpose in the form of ball and roller bearings. They've given us materials that resist the action of acids and alkalies in the form of corrosion resistant alloys, plastics and surface coatings. All construction materials whether mineral, vegetable or animal in origin are being strengthened through technical research to resist physical deformation.

The design engineer takes these improvements into consideration when he develops a machine. We are all acquainted with household equipment which operates for years without much if any service attention on our part. For industrial use we see these improvements incorporated in the design of power transmission machinery, speed reducers, gear-motors, ball and roller bearings and special machines in countless numbers, all to seal out contamination and retain an internal bath of clean oil or grease which cools and lubricates the sliding metal surfaces.

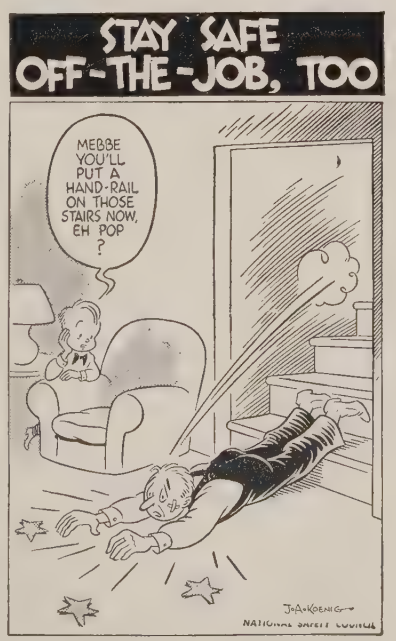
Household Appliances Superior to Industrial Equipment

UNFORTUNATELY, most of our industrial machinery has not been blessed with these improved designs and we find it necessary to give constant lubrication attention to thousands of wear-points in our equipment. Sliding surfaces destroy one another on intimate contact; therefore they must be separated by a thin film of lubricating oil.

Poor lubrication practice is one of the sure ways to court a shutdown and the attendant waste. A starved or dry bearing quickly leads to failure and machine shutdown. Such a condition may be due to neglect, but it may also be caused by the use of an inadequate lubricant—one that forms deposits which plug up oilways. On the other hand, good lubrication practice and correct lubricants provide low-cost insurance against wear and forced shutdowns.

Diagnosis for Each

THE first line of defense against the enemy EROSION, is a good lubricating program. Such a program starts with a survey of the plant machinery by a qualified lubrication engineer working in conjunction with a time study engineer. The proper type of lubricant, frequency and quantity to be applied, is determined for each wear point. With this information routes are established for each individual oiler.



The oiler then becomes the important man in the program. Here at Roby we have eight oilers who fight this constant battle against Erosion. They are: Joseph Domagalski, William Miskosky, Alex Sabaitis, Govan Taylor, Cornelius Thomas, Wesley Lindsay, Denovious Rivers and Ruby Gorence. They perform a very valuable service in this business of maintaining our plant in good working condition. From The Amaizo *Corn Ear*

SABOTAGE!

Yes, believe it or not, there are some employees in your plant actually sabotaging their own and the plant's safety records.

These are the same employees who are not safety minded, who believe that the company safety rules and regulations are made for other employees—but not for them.

These employees must be educated to be safe. It's up to the personnel department, supervisors, employees, as well as the safety department, to do the educating.—R. P. Alden, American Chicle Co.

Agricultural Variegations

1. The City Speculator

He bought his stock at twenty;
It climbed right up a-plenty.
Until the slump—and THEN look where it went.
You should have heard him grumble when
His profits disappeared again,
'Cause this year he will hardly make a cent!

2. The Country Speculator

He bought his farm at twenty
And now the poor old gent, he
Is Fifty-five; that is, if he's a day,
He should have sold at forty-two
But now there's nothing he can do
But maybe give the dog-gonned place away!

—Wm. Porter, Grand Forks.

A Comparison of the

RESPIRATION AND STORAGE BEHAVIOR of Soybeans with other Grains

PART II

By PAUL E. RAMSTAD and W. F. GEDDES

Division of Agricultural Biochemistry

University of Minnesota Agr. Exp. Sta.

This illuminating treatise explains the behavior of stored products with clarity and definiteness, answering several major questions that confront those charged with the safekeeping of grains, beans, and their by-products, etc. While this study is necessarily technical, time spent in thoroughly digesting its full significance will truly be an investment in further understanding of what is going on "behind the scenes," as it were.

Bulk Storage of Soybeans

WITH the coöperation of a local soybean processor, it was possible to check the laboratory data on respiration and heating against the behavior of soybeans in bulk storage. For experimental purposes an interstitial bin was filled to a depth of 97 ft. with 987,000 lb. of soybeans with an average moisture content of 15.82% (Tag-Heppenstall). The lowest and highest moisture lots in the bin were 14.0 and 18.0% moisture as determined by the Tag-Heppenstall electric moisture meter. Table 21 shows the weights, grades, and moisture contents and relative depths of the various lots in the bin. Of these soybeans, 6% graded 2, 56% graded 3, and 38% graded 4.

The filling of this bin was begun November 14 and completed November 19, 1941. At intervals during the storage period, a ½-in. steel pipe with a perforated tip was forced into the beans for the purpose of withdrawing gas samples and reading temperatures at the various levels. No readings could be taken more than 50 ft. below the surface since this was the maximum depth to which four men employing special clamps were able to force the pipe. Temperatures were taken by lowering a thermocouple into the pipe. Gas samples, obtained by connecting a sample tube and vacuum pump to the upper end of the pipe, were analyzed for carbon dioxide and oxygen with a Haldane-Henderson apparatus.

Table 22 shows the temperatures recorded to the nearest degree Fahrenheit at various depths below the surface. Analyses of gas samples drawn from various depths are given in table 23. During the first month's storage, the temperature remained practically unchanged, and very little carbon dioxide was found in gas samples removed from various depths down to 50 ft. below the surface. During the second month, however, the temperature increased rapidly, and a temperature of 99° F. was attained 40 ft. below the surface; at this level the greatest change in gas composition had taken place: 16.9% carbon dioxide and 1.0% oxygen.

It should be noted that, in this study, the soybeans were cool when placed in storage, and the outside temperatures were always low. During the first week in January, the outside temperatures ranged from 0° to —20° F. and were responsible for the low temperature reading at the five foot depth on January 5. More than five feet below the surface

Table 21. Description of Soybeans in Elevator Bin.

Wt. of carload	Grade	Moist.*	Approximate depth in bin
lbs.		%	feet
57,680.....	4	18.0	surface- 5
116,350.....	4	17.3	5 -17.5
64,500.....	3	14.5	17.5-23.5
78,580.....	3	15.3	23.5-31
60,000.....	3	15.9	31 -37
79,480.....	4	17.8	37 -45
82,970.....	3	15.9	45 -53
82,200.....	3	14.3	53 -61
80,900.....	3	15.2	61 -69
59,800.....	2	14.0	69 -75
123,440.....	4	16.0	75 -87
100,940.....	3	15.0	87 -97

*Determined with Tag-Heppenstall moisture meter.

Table 22. Temperatures Observed at Various Depths Below Surface of Soybeans in Elevator Bin

Depth below surface	Date sampled and number of days after storage						
	Nov. 26	Dec. 2	Dec. 16	Dec. 26	Jan. 5	Jan. 13	Jan. 20
	7 days	13 days	27 days	37 days	47 days	55 days	62 days
Feet	°F.	°F.	°F.	°F.	°F.	°F.	°F.
5	45	45	40	41	34	45	52
10	46	46	45	47	55	59	55
15	46	47	45	48	54	61	58
20	47	47	46	48	56	65	60
25	48	47	47	49	57	67	62
30	48	47	47	50	58	69	64
35	48	47	48	50	60	69	78
40	46	47	47	50	62	67	99
45	48	48	47	50	60	64	101
50	48	49	47	50	58	78	82

the soybean temperatures did not appear to be greatly affected by the outside temperature.

The oxygen and carbon dioxide contents of the interseed atmosphere at various depths indicated that ventilation was taking place throughout the bin. The relative changes in concentrations of oxygen and carbon dioxide were considerably less than would be expected from laboratory studies of the respiratory activity of soybeans undergoing heating.

Table 23. Composition of Interseed Air at Various Depths Below Surface of Soybeans in Elevator Bin.

Date sampled and no. of days after storage				Date sampled and number of days after storage					
Depth	Gas	Dec. 2	Dec. 9	Depth	Gas	Dec. 26	Jan. 6	Jan. 13	Jan. 20
		13 days	20 days			37 days	48 days	55 days	62 days
Feet		%	%	Feet		%	%	%	%
2.5	CO_2	0.31	0.27	5	CO_2	0.55	0.51	0.80	1.90
2.5	O_2	19.99	20.10	5	O_2	19.71	19.69	19.73	18.07
8	CO_2	0.40	0.35	10	CO_2	0.80	8.56	1.01	2.01
8	O_2	19.80	20.10	10	O_2	19.18	17.01	19.39	17.60
16	CO_2	0.46	0.31	20	CO_2	0.91	3.13	4.34	4.29
16	O_2	19.57	20.10	20	O_2	18.66	16.51	14.90	14.84
24	CO_2	0.57	0.33	30	CO_2	1.54	4.17	5.37	6.03
24	O_2	19.48	20.10	30	O_2	17.76	15.89	13.46	11.94
32	CO_2	....	0.38	40	CO_2	3.14	2.09	10.61	16.93
32	O_2	....	20.10	40	O_2	16.16	18.13	8.16	1.05
				50	CO_2	1.39	1.02	3.58	8.40
				50	O_2	18.06	19.29	14.73	8.82

On January 18 a sour odor emanating from the bin gave evidence that spoilage might be greater than the temperature would indicate. On January 20, 62 days after the experiment was begun, the bin was emptied and composite samples taken at several time intervals. Soybeans from the bottom of the bin were cool and sweet although the moisture content determined by the two-stage vacuum-oven method was 17.8% (Tag-Heppenstall value 16.0%). Another sample, representing a later period during the emptying of the bin, which likewise appeared to be undamaged, had a moisture content of 19.2% (Tag-Heppenstall value 17.2%). These samples rapidly became moldy when stored at room temperature.

Although the highest temperature observed was 101° F. (38.3° C.), about 40,000 lb. of beans were damaged as evidenced by a brown discoloration and a sour odor. A sample of these soybeans had a moisture content of 20.3%, while a small quantity of very severely damaged beans contained 28.0% moisture, as determined by the two-stage vacuum-oven method. From the moisture values of the four samples it would appear that the beans were not adequately sampled before storage; the difficulty of obtaining a representative sample from a carload of damp soybeans by the usual probing methods is well recognized by the trade.

The two samples of damaged soybeans were submitted to the Division of Plant Pathology to determine the nature of the microörganisms present. Bacteria and fungi were both found in abundance. The bacteria were not identified but were considered to be the agents responsible for the brown discoloration of the damaged soybeans and for the sour odor which was present. Surface sterilization techniques indicated that the bacteria and fungi were present not only on the surface of the beans but in the interior as well. The following fungi were identified as being present in these samples:

Alternaria sp.
Fusarium sp.
Penicillium sp.
Aspergillus repens group
Aspergillus niger group
Chaetotheca sp.
Verticillium sp.
Aspergillus flavus-oryzae group
Mucorale
Rhizopus nigricans
Acrostalagmus sp.

From laboratory studies of respiratory rate, it seems evident that if the soybeans had been stored at a higher initial temperature, or for a longer time, very extensive damage would have occurred. The fact that there was some spoilage with a maximum recorded temperature of 101° F. indicates that soybeans may undergo considerable damage without excessive heating.

This experiment lends further proof to the conclusion, earlier drawn from laboratory experiments, that there is a definite risk involved in storing soybeans at moisture contents permitted in the grade definitions for Nos. 3 and 4, namely 16 and 18% as determined by the Tag-Heppenstall moisture meter.

Production of Carbon Monoxide by Heating Soybeans

VERY little is known regarding the nature of the volatile substances, other than carbon dioxide, produced in a mass of heating grain or of the processes by which they are formed.

As far as the authors are aware, no authenticated reports of the production of carbon monoxide in heating grain are in the literature. Langdon[30] and Langdon and Gailey[31] found from 1 to 12% of this gas in the hollow pneumatocysts of *Nereocystis luetkeana* and considered it to be a respiration product of this kelp. According to Haldane and Makgill[24], small quantities of carbon monoxide are formed in the oxidation of wet hay at 40°C. if bacteria are excluded. When bacteria were present, they found that hydrogen was formed instead.

In 1941 the Industrial Health Division of the Minnesota Department of Health, employing the Mines Safety Appliances Company carbon monoxide indicator, found up to 0.03% carbon monoxide in the interseed air of sample grade flaxseed in commercial storage. In this apparatus the carbon monoxide is catalytically oxidized to carbon dioxide by means of a special catalyst (hopcalite) and the heat of the reaction measured electrically. Water vapor, hydrogen, and hydrogen sulfide may interfere with the test. Provision is made in the apparatus for the removal of moisture, while hydrogen is only oxidized by the catalyst at elevated temperatures. Qualitative tests for hydrogen sulfide were negative and hence the results obtained with this device provide strong evidence of the actual presence of carbon monoxide in the interseed air of the flaxseed bin.

These tests for carbon monoxide in gases drawn from various depths in the soybeans were carried out 62 days after the soybeans were placed in storage. No carbon monoxide was found in the interseed air to a depth of 20 ft. below the surface, however several samples drawn from depths of 20 to 50 ft. gave carbon monoxide values varying between 0.005 and 0.02%.

Confirmatory evidence of the formation of carbon monoxide was obtained from a sample of soybeans undergoing heating in the small adiabatic respirometer. A more specific test was strongly positive, thus proving the production of carbon monoxide by heating soybeans. The mechanism of its production and the quantities produced under various conditions are still unknown.

Discussion and Conclusions

THESE studies show that moisture content and temperature do not alone determine the respiratory activity of a sample of soybeans. Of very great importance is the history of the sample prior to the time the respiratory rate is determined. Samples at moisture contents above 13% were observed to show increases in respiratory activity as great as several hundred per cent when stored for a few weeks at room temperature. The respiratory rates attained when stored under these conditions bore little relation to the rates found soon after conditioning or after storage at low temperatures.

Several lines of evidence indicate that the high respiratory rates observed after storage at high moisture

levels and moderately high temperatures were due chiefly to microorganic activity. Beans which exhibited these high respiratory rates usually were visibly moldy or had a musty or a sour odor and bacteria and a number of fungi were found in abundance. Moreover, higher respiratory rates were observed in nonviable beans than in beans of high viability.

Attempts to sterilize grain and thus separate these two sources of respiration are always likely to affect the respiration of the grain itself; moreover, surface sterilization techniques cannot be effective because bacteria and fungi appear to be present inside as well as on the surface of the soybeans. It is questionable whether the smooth curve given in figure 3 represents the true respiratory activity of soybeans. It can only be stated that the respiration due to microörganisms was at a minimum. While organisms were present, they were not given sufficient time under the proper conditions to proliferate before the respiratory rates of these samples were determined.

That the inherent respiration of soybeans may be relatively unimportant is indicated by the results of the experiment in which heat-treated beans were inoculated with a water extract of moldy soybeans. The respiratory rate of these beans determinted after ten days' storage was approximately equivalent to that of unheated beans of the same moisture content stored under similar conditions.

The more vigorous respiration of split than whole soybeans when both were stored under conditions favorable to the development of microörganisms may be explained by the greater surface of the split soybeans on which microörganisms can grow and also by the lack of the seed coat which partially protects whole beans against invasion by microscopic flora.

The fluctuating rates of carbon dioxide production observed in the instance of soybeans undergoing heating in the adiabatic respirometer suggest that different organisms predominate at various stages of the heating process.

The rapid decrease in the viability of soybeans under conditions which favor the growth of microörganisms raises the question whether bacteria and fungi are responsible for the decrease in germination capacity or if they are entirely saprophytic and become active only after the beans are nonviable. This question cannot be answered from the studies conducted but it is clear that conditions which will inhibit the growth of microörganisms are the most favorable for the storage of soybeans.

The lowest moisture content at which soybeans were observed to heat was 15.6%. Increases in respiration with time of storage were marked in soybeans containing over 13% moisture when stored at room temperature; furthermore, the iodine number of oil from such beans was greatly reduced, although the quantity of oil did not seem to be diminished. Soybeans remained sound and retained their viability well at a moisture content of 15.8% for a year and a half when stored at 39° F. On the other hand, when stored at room temperature, viability was seriously diminished even below a moisture content of 10%.

The moistures given above were determined by the two-stage vacuum-oven method. It is found that as far as moisture content is concerned, soybeans in grade No. 1 may be stored under most conditions; Grade No. 2 may be safe under most conditions of storage but for a shorter time; grades Nos. 3 and 4 involve a great storage risk and should be stored only for short periods at low temperatures. When soybeans are stored at the high moisture contents allowed in these latter two grades, temperatures should be closely watched and the beans moved when any heating is observed. Damage can occur without excessive heating.

If soybeans are to be kept for seed purposes during warm weather or for a long period of time, it seems advisable to store them at a moisture content of 10% or less. With unfavorable harvest weather, artificial drying may be necessary to reduce the moisture content, and investigations are needed to ascertain the drying conditions which may be safely employed without injury to germination.

The biochemical studies carried out with soybeans stored for 12 months at various moisture levels support the view that carbohydrates are the first food materials utilized in respiration. Calculations of the apparent specific heat of soybeans from the data of the adiabatic respirometer experiments also seem to indicate that heating results primarily from the oxidation of carbohydrates.

Calculations employing the data obtained in the bulk storage experiment indicate that considerable aeration of soybeans takes place in commercial elevator storage. Thus from table 22 and table 23 it will be noted that after 62 days' storage the temperature of the beans at a depth of 40 ft. had increased approximately 86° F. while the carbon dioxide concentration in the interseed air at this level had risen to 16.9%.

For a temperature increase of 86° F., the estimated volume of carbon dioxide produced is approximately six times the volume of the interseed air space. That heating of grain sets up convection currents and results in considerable aeration has recently been indicated by studies carried out by the Division of Agricultural Biochemistry on flaxseed in elevator storage. Samples of interseed air drawn from various depths in sample grade flaxseed of uniform moisture content stored in an interstitial bin exhibited a progressive increase in oxygen and decrease in carbon dioxide at depths below 30 ft.

If all the water produced by respiration in the above calculation were absorbed by the beans, their moisture content would be increased only approximately 0.2%. It therefore appears that any appreciable increase in moisture content in a localized portion of a bin is more likely to be the result of condensation or the hygroscopic uptake of water from atmospheres of high relative humidity than the result of water produced as an end product of respiration.

Summary

As compared with published data for the cereal grains, the moisture content of soybeans was found

to increase more rapidly with increasing humidity. Soybean oil meals were somewhat more hygroscopic than whole beans; this was attributed to the lower oil content of the former. Toasted solvent-extracted and expeller meals were similar and slightly lower in hygroscopicity than untoasted solvent-extracted meal, but the differences were not great enough to have practical significance. Soybean oil meals were less hygroscopic than wheat flour at relative humidities below 70% but became considerably more hygroscopic than wheat flour at relative humidities above 70%. This implies that such meals will show considerable changes in weight depending on the atmospheric conditions under which they are stored and, furthermore, will be very prone to spoilage when stored in atmospheres of high relative humidities.

Respiration was measured by determining the amount of carbon dioxide produced by a known weight of soybeans during incubation at constant temperature for a four-day period. Except when temperature was the variable studied, this incubation temperature was 100° F. since this was regarded as an extreme temperature condition under which grain is likely to be stored. When respiration was measured soon after conditioning beans to a range of moisture levels, the acceleration of respiratory rate with increasing moisture content was very regular, and a smooth exponential curve resulted from plotting moisture content against respiratory rate.

Irregular but very great increases in respiratory rate occurred when samples above 13% moisture content were stored for a few weeks at moderate temperatures before determining respiratory activity. These increases were of the order of magnitude of several hundred per cent and were believed to be caused by the growth of microörganisms. Such samples were visibly moldy or possessed a sour or a musty odor.

Other experiments on the effect of storage temperature, temperature at which respiratory activity was determined, comparative respiration of whole and split soybeans when stored under identical conditions, and the respiration of heat-treated beans which had been dampened with sterile and with inoculated water, all seemed to confirm the theory that microörganisms are the primary cause of the excessively high respiratory rates responsible for heating and other damage to stored soybeans.

Rapid loss of viability [germination] was caused by conditions which favored the growth of microörganisms in soybeans. Viability was better retained in beans stored at 15% moisture and a temperature of 39° F. than in beans from the same lot stored at 9% moisture and room temperature. To retain high maximum germination capacity, soybeans should be stored at a low moisture content (approximately 10%) and at as low a temperature as feasible.

Considerable damage was observed in soybeans stored at high moisture levels at room temperature even though heating did not occur. This damage appeared to be caused by microörganisms. Soybeans were stored at a series of moisture contents for a period of one year at room temperature. The most important chemical differences observed were that high moisture beans had more reducing sugar, less nonreducing sugar, and lower iodine number of the oil than those stored at low moisture contents. Catalase activity and *p*H first dropped with increasing moisture but then increased in the case of the moldy samples.

Adiabatic respirometers of two types were used for laboratory studies of soybean heating. The larger held nearly six bushels and was loaded with beans at moisture contents of 18.8, 17.5, 15.6, and 14.7%; all samples heated except the one at 14.7% moisture. Time required to reach maximum temperature decreased with increasing moisture.

The smaller apparatus which held only one quart was used in later experiments. With this equipment, aeration was controlled and carbon dioxide production measured. Soybeans of 24.5% moisture attained a temperature of 191° F. Samples placed in the respirometer immedi-

ately after conditioning did not heat until after an increase in respiratory rate had occurred; the time required for this increase corresponded very closely with that necessary for the appearance of visible mold growth. Respiratory rate did not show a regular increase with temperature; instead it increased and decreased in irregular waves. This was interpreted as resulting from changes in the predominating flora with changes in temperature. Aeration was found to be necessary for heating to take place.

Bulk storage of 987,000 lbs. of soybeans, grading U. S. Nos. 3 and 4 with an average moisture content of 15.82% (Tag-Heppenstall), for two months resulted in heating despite low atmospheric temperatures. Considerable damage occurred even though the maximum temperature observed was 101° F. Calculations of the theoretical amount of carbon dioxide produced by heating soybeans together with the analyses of gas samples drawn at intervals from various levels in this bin indicated that considerable aeration took place. Moisture produced by respiration even at relatively high rates is not sufficient to increase appreciably the moisture content of soybeans; large localized increases in moisture content are more likely to be the result of condensation or the hygroscopic uptake of water from atmospheres of high relative humidity.

A wide variety of fungi was isolated from soybeans drawn from the bin at the conclusion of the experiment. Bacteria and fungi were found both on the surface and in the interior of the damaged beans.

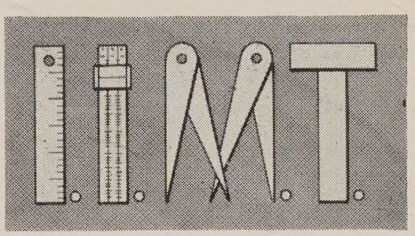
Carbon monoxide was detected by qualitative tests in the gas drawn from heating soybeans both in the elevator bin and in the small adiabatic respirometer.

The lowest moisture content at which soybeans were observed to heat when stored at laboratory temperature (770—790° F.) was 15.6%, as determined by the two-stage vacuum-oven method. Grades Nos. 3 and 4 involve a great storage risk except for relatively short periods at low temperatures.

Condensed from a thesis submitted by Paul E. Ramstad to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Doctor of Philosophy. This is a study made in coöperation with the U. S. Regional Soybean Industrial Products Laboratory, a coöperative organization participated in by the Bureau of Agricultural Chemistry and Engineering and the Bureau of Plant Industry of the Agricultural Research Administration of the United States Department of Agriculture and the Agricultural Experiment Stations of the North Central States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. It is published as Technical Bulletin 156, University of Minnesota Agr. Exp. Sta.

References to literature cited available upon request.

Thought takes a man out of servitude into freedom.—R. W. Emerson.



LUBY LEAVES LIMA

Well known Tom Luby, active IIMT member, has left his Lima, Peru, flour milling connection because, according to reports, Mrs. Luby didn't care for the climate. At the present he is taking a well earned rest at Monett, Mo., where his street address is 517 Frisco Ave.

McCLELLAND GETTING BETTER

After my return from the Chicago AOM convention I suffered a severe heart attack and until recently was confined to bed. I am greatly improved, although the trouble is not entirely cleared up.—Heber B. McClelland, Arizona Flour Mills Co., Phoenix.

ACKELS NOW WITH I-H

Arthur Ackels, widely known milling superintendent of Springfield, Mo., joined the Ismert-Hincke Milling Co., at Topeka, Kan., on Nov. 15. His many IIMT friends wish him every success in his new post.

IT'S NOT TOO EARLY!

It's not too early to send in for reservations for yourself and party for the 18th Annual S.O.G.E.S. convention to be held at the Hotel Continental, Kansas City, Mo., May 15-16-17. Be sure to give approximate arrival and departure times. First come, first served.

Weevil-Cide SPLITTERS

BLIMEY!

"I want an E string for my violin," said the customer at the London music store.

The girl clerk ducked behind the counter and came up with all the violin strings in the shop.

"Pick it hout yourself," said she. "I carn't tell the blinkin' 'es from the shes."

* * *

NO PERCENTAGE

"How about buying a chance? We are having a raffle for a poor widow."

"No use. My wife wouldn't let me keep her if I won."

* * *

IDENTITY CONCEALED

Bank teller: "This check is undoubtedly okay, but do you have anything by which to identify yourself?"

Lady (hesitantly): "Well, I have a mole just above my left knee."

* * *

DISCOURAGED

Police Judge: "Well, Sam, about your son stealing those chickens: I've decided to let him off this time, but why don't you show him the right way?"

Sam: "Ah done tried hard, Jedge, but he goes and gets hisself caught anyway."

* * *

SPEED REQUIRED

Excited voice from window: "Quick, a man has just been shot. Get help."

Bystander: "Okay, I'll call a doctor and tell him to take the lead out."

OCCUPATIONAL HAZARD

Gertie had a new job in a flower shop. It had been a very busy day. Her friend, Madge, came in near quitting time to wait for her.

"Am I ever tired!" said Gertie.

"Guess they keep you plenty busy" said Madge sympathetically and then, suddenly thinking of a plant she had been wanting to buy, exclaimed, "Say, do you have a trailing arbutus?"

"I wouldn't be surprised," said Gertie. "If you'd taken as many steps as I have today, you would too."

* * *

DAILY GOOD TURN

Mother to pugilistic son: "When I looked out of the window, Johnny, I was glad to see you playing marbles with the boy next door."

Son: "We weren't playing marbles, Ma. We just had a fight and I was helping him pick up his teeth."

* * *

INEVITABLE

Men who drive with one arm are headed for church. Some will walk down the aisle—others will be carried.

* * *

HANGING TOO GOOD

Mrs. Brown, called up for jury duty, refused to serve on a case because she said she didn't believe in capital punishment.

"This is merely a civil case" it was carefully explained to her, "where a wife is suing to recover $500 she states she gave her husband to pay on her fur coat and which she alleges he later lost in a poker game. There is no question of capital punishment involved in this case."

"Well, I'll serve then," said Mrs. Brown. "And anyway, I could be wrong about capital punishment."

MAKE UP YOUR MIND

At a muddy crossroad corner in the deep South is a sign that reads:

CHOOSE YOUR RUT CAREFULLY
YOU'LL BE IN IT 20 MILES

* * *

NO TIE-IN SALE WANTED

Lady: "Two dozen diapers, please."

Clerk: "That will be a dollar and a half, plus 8 cents for tax."

Lady: "Never mind the tacks. I use safety pins."

* * *

WHO, ME?

Doctor: "Your husband must have rest. Here is a sleeping powder."

Wife: "When do I give it to him?"

Doctor: "You don't give it to him. You take it yourself."

* * *

HISTORY

Asked to write a brief essay on the life of Benjamin Franklin, a little girl wrote:

"Benjamin Franklin was born in Boston, traveled to Philadelphia, met a lady on the street, she laughed at him, he married her, and discovered electricity."

* * *

NO ARGUMENT

"Mandy, wasn't that the telephone?" asked her mistress. "For whom was the message?"

"Wasn't nothin'," Mandy declared. "Lady done say to me, 'Long distance from Atlanta.' I says, 'Yas'm, it sho is'—and dat were all dey was to it."

* * *

IT ALL DEPENDED

Mandy: "Whaffo' yo' sharpenin' dat razuh?"

Rastus: "Woman, dey's a paih o' gemmun's shoes undeh you bed. If dey ain't no feet in dem shoes den Ah'm goin' to shave."

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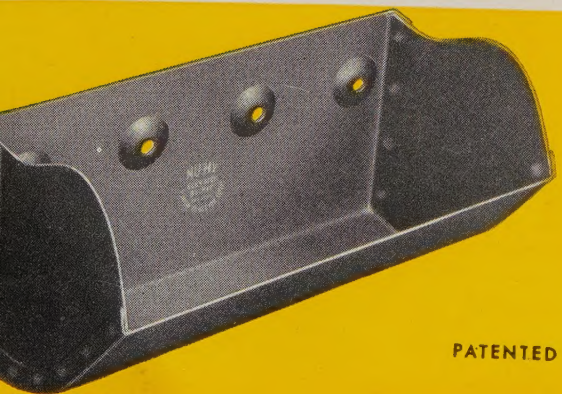

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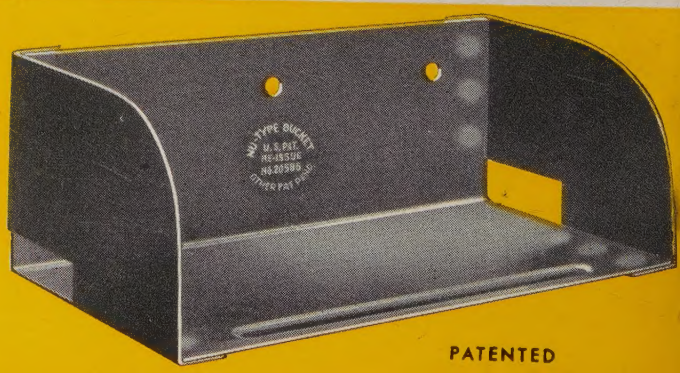

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